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# South Katraj Region: A Source of Dust Pollution

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***Abstract: The earth's atmosphere is composed of various gases which contain various harmful elements in different quantities. The compound mass of gases sometime show adverse effect on living organisms as well as some of them are very much essential for every living organism on the earth's surface and assist their survival, however the depletion of ozone i.e. stratospheric ozone depletion has been recorded which is a proved as a threat to life on the planet as well as the ecosystem. The several methods are adapted globally to measure ambient air quality and its parameters. Around thirteen parameters were examined by CPCB in Pune in 2007. After the core study of air parameters, dust found as an important constituent of polluted air which is causing many problems in daily day life.South Katraj region is an ideal home of quarrying units. Many Crushers are running since last few decades to produce large quantity aggregates which serve many construction activities nearby Pune. Dust is product of such quarrying and huge quantity of dust is falling over South Katraj area. These research works with fine experimentation have focused of huge dustfall and its distribution. The seasonal dustfall, its distribution and behavior is studied carefully to find the best solution which will help control the quality air around selected study area.***

**Keywords: South Katraj Region, Dustfall, Dust Pollution, Air Quality.**

## I Introduction

Pune is a well developed and 9th populous city in our country and its ranks 2nd largest in the state of Maharashtra. It's made over Deccan plateau, on the right bank of the Mutha river. It considered as a cultural capital of the state [1]. The total population of city according to 2001 census was 1, 99, 97,778 persons which 1, 02, 94,635 were males and 1, 20, 94,635 females [2]. The total area of city is of around 57,775 Km2 and density was 346 persons for every Km2 area of the city. Pune city is a part of the Maharashtra plateau and forms the Western Maharashtra Upland, with several variations in relief. The average height of city area is about 560 meters above MSL [2].

The report published by CPCB in 2007 contained the details of air quality monitoring, dispersion modeling, emission inventory preparation source apportionment and air quality management plan for city of Pune. The whole report is divided into eight different parts [3]. The study done by CPCB had generated baseline date of ambient concentration of critical parts of city. The selected study is based on the concentration of dust matter present is South region of city. Contaminants flying in air occur in the gaseous form or as aerosols. In scientific language, an aerosol is term as a system of particles suspended in a gaseous form, frequently air in the context of occupational hygiene. These aerosols may form of sprays, mists, dusts, smokes and fumes. Airborne dusts are mainly responsible for widespread occupational lung diseases [4].

Dust is a mixture of various particles present in the atmosphere which made up of varies sources like as soil, vegetations and other tiny matter such as human and animal hairs, paper fibbers, textiles fibbers, human skill cells etc. Dust can be classified as domestic dust, atmospheric dust and road dust.

Dust generally contains:

- Dust from minerals which may containing free crystalline silica, coal dust and cement particles;
- Dust from metal such as lead, nickel, cadmium and particles of beryllium;
- Chemical dusts, such as complex chemicals and chemicals from pesticides:
- Vegetable dusts, like as flour, cotton, wood and tea dusts, pollens;
- biohazards Dust, like as viable particles, moulds and spores

Dust can be control by suppression of fine particles with diameters below 500 micrometers. Such tiny dust particle affects health of children as well as older persons. Coal dust is also one of the types of dust which is very dangerous to lung diseases.

Dust exposures: Many construction activity and work processes involve operations form appreciable dust exposure whenever they are not properly planned, supervised, controlled. Such dust exposure pose serious health hazard. The interaction of visible light with a system of dust particles is very composite. The visual appearance of dust particles will be dependent on the wavelength of the light and the angle of viewing with respect to the light source, as well as dust particle size, shape of particles, refractive index and density of dust [4].

Dusty occupations: Dust exposure is mainly related to occupation in the places of agricultural and industrial settings, which is briefly listed below

- agricultural work;
- chemical and pharmaceutical industry ;
- stone-working and construction, mining, quarrying and tunnelling;
- shipbuilding;
- foundries and other types of metallurgical activity;
- manufacture of cleansing agents and abrasives;
- manufacture of glass, ceramics, etching glass;
- rubber manufacturing industry;
- removing paint and rust from buildings, bridges, tanks and other surfaces;
- manufacture of lead storage batteries ;
- food industry;
- forestry and woodworking;
- formulation of pesticides

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Transportation is also a major source of dust pollution which contains transportation of loaded as well as empty vehicles, transportation of bags or containers with powdered materials. Road traffic, unpaved road sides are also responsible for dust emissions [4]. Many mechanical operations like turnings; grindings produces large amount of metallic dust particles of varies diameters. Many hard metals like nickel, cobalt, chromium, vanadium and tungsten are being emitted in open atmosphere due to such mechanical operations. Hard dust particles are very harmful for human health.

The different sizes of dust particles mainly suspended particles i.e. suspended particulate matter (SPM) flows in the air for varying time period which depend in their sizes and weights. The larger sizes i.e larger than 10 µm particles, settle due to forces of gravity. The settling of particles may be on the surface of vegetations or on soil on open land (Rao, 1985). Rao and Prasad in 1981 observed the decrease in content of protein and carbohydrate in petroleum–coke treated plants. The Experimentation shown the initial increment in content of chlorophyll but later it decreased gradually.

According to the study done by Fowler et al. (1989), the gasses pollutants and particulates have a more impact in forest than in grasses of shorter length [5]. The different physical and chemical nature of airborn pollutants adversely affects plants. The observation of Jahan and Iqbal shown the reduction in area of leaf of five species of trees due to excessive dust pollution. Tripathi and Prajapati (2008) studied dust accumulation efficiency of few selected plant species. The research stated that the maximum dust deposition was found in winter. The research work of Ramanathan stated that the heavy air pollution defined as Atmospheric Brown Cloud (ABC) which mainly based on radioactive affects and cloud condensation nuclei (Ramanathan et al., 2001) [6]. In the meantime, the developed regions like United States and Europeans countries remain main pollution sources. Maximum impact on ozone over Europe was found during summer season (Wild et al., 2001; Stohl and Trickl, 1999; Guerova et al., 2006;Li et al., 2002, 2005;). The study of Stohl shown that, the European pollution had increased the ozone concentration over Northern Africa. (Duncan and Bey, 2004; Stohl et al., 2002) [7]. According to the Environmental Protection Rules, 1986 the suspended particulate matter value of a unit should be below 600 µg / $m^3$. It was observed that the suspended particulate was lowest during rainy season and highest in winter in the study of Lal Pahari Forest [8]. Dust deposition was maximum in summer and minimum in rainy season. About 14 times higher dustfall observed on Madhuca Indica leaf [9].

## II Material and Methodology

The selected area for experimentation is South region of city of Pune. Pune district is situated at an elevation of 55.71 Km above the MSL and comes under the transitional belt and the city is placed between $17^0$ N altitude, $73^0$ , and $75^0$ E longitude. The north-south area of the district is cover by Sahyadri hills. Pune district bounded by Solapur and Satara districts in the south direction and Ahmednagar district in the north, Thane and Raigad district of the west, Solapur and Ahmadnagar districts of the east. The geographical structural of Pune city is classified in three distinguish Ghats zones known as Western Ghat Zone, Hill Areas and Pathar of Eastern Zone.

*Climate condition and Rainfall:* The climate variation at different places is found in Pune district since last few decades. At the hill region and Western Ghat is cool and other region is of hot and dry climate. The measured temperature of Pune city ranged between 34ºC and 41ºC during summer, while the minimum temperature varied between 6º C to 11º C in the winter season. This region is followed by an average annual rainfall of 676 mm and mean rainfall region is an eastern part of the district having an average rainfall of around 650 mm. The maximum rainfall is around 1171 mm, found in western region of the district.

*Topography of area:*

Selected part of Pune district posses three types of soils viz. Brown soil, black fertile soil and mixed type. The eastern region of Pune district having plain fertile soil type while western region soil is of low quality with brown type. The seven rivers of the region carry alluvial soil for the district which favours the agro-climatic condition.

Selection of Study Station: The whole area was divided into four parts known as station. The stations again classified under few sub-stations to cover the total area of South Katraj Region.

The study of dust pollution in South Katraj area was started in Jan 2015. The selected area of study was as follows

- Station 1: Khadi Machine Chouk, situated between Katraj and Hadpsor Bypass near Kondwa Road which is known as heavy traffic junction.
- Station 2: ISKON Temple and Yewalewadi, situated near Katraj which having new construction industries and new arriving building projects.
- Station 3: East Zone of Yewalewadi, i.e. Wadachi wadi.
- Station 4: KJEI Engineering College Campus, situated in the beginning of Bopdev Ghat.

All the above stated stations again sub divided into few locations. It is represented in Fig. No. 1.

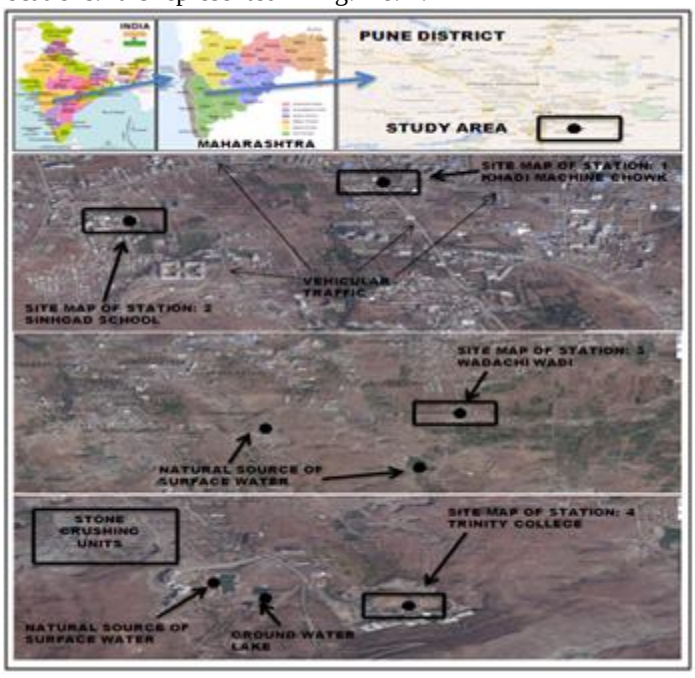


*Fig. 1: Map Representing Study Areas*

*Measurement of dustfall*

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The selected study area is continuously influenced by number of crushers which are producing thousands tones of aggregates since few years. Such production of huge aggregates produces large quantity of dust particles. The layers of dust particles are carried over the nearby area and the concentration of layer depends on wind blow direction. The experimentation was done by using glass jars of diameter of 10 mm and height 15 mm. The method is well known as glass-jar method. In this method, few glass jars (dry) were pre-weighted and placed at different elevation at selected study locations of study area. The placed glass jars were allowed to collect dust from open atmosphere. The glass jars with dust ware weighted accurately. The initial weights of glass jars were deducted from the respective final weights to get the weight of accumulated dust. The dust deposited in glass jars were calculated in g/ $m^2$ day. The final dust fall was measured by following formula

Where ($\pi r^2$) is the cross sectional area of the jar mouth in m2, 1 is one day duration of dustfall testing, n is the actual duration in hours for which glass jar was exposed [8].

## III Results and Tables

*Measurement of dust concentration:* The collected dust was weighted accurately to get the areal dust fall in the study area. All the stations were observed for 7-8 weeks since Jan 2015 to April 2015. The maximum dust fall for every station was observed in the weeks of summer where as the dust fall was of lower values in weeks of winter season. The maximum dust fall was observed at Station No. 3 as it is under the influence of two crushing zones. The maximum dust fall of 350 g/m2 was recorded for Station No.3 i.e. Wadachi Wadi. The lowest dustfall was around 50 g/m2 and recorded at Station No. 4 for Station No.3 i.e. Wadachi Wadi. The lowest dustfall was around 50 g/m2 and recorded at Station No. 4 for sub-station 4 (3).

The Station No. 4 was selected near KJEI college campus which is situated closer to stone crushing industry. The noted values for the dust concentration for Station No. 4 (1), Station No. 4 (2) and Station No. 4 (3) is minimum as is it situated at higher elevation as compare to other study stations. The comparative graphical representation is given in Figure No. 2.

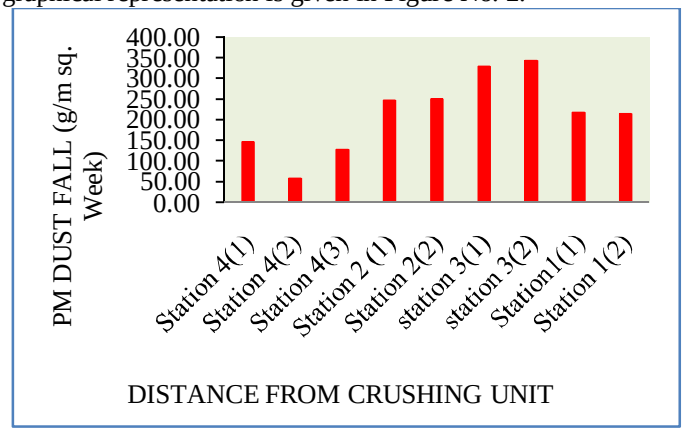


*Fig2. PM dust fall (g/m sq. Week) vs distance from crushing unit*

## IV. Conclusion

The crushing units running around South Katraj area produce huge dust of 350 g/ $m^2$ which is very high. The associated processes such as mining work, blasting, cutting of rock bands, hauling and transportation, processing and transport on aggregates are the major reason of dust pollution in selected study area. The dry climatic condition, lack of vegetative cover around the area and strong winds over the period of years, favor the formation of dust clouds as observed during study periods. Large production of the aggregate produces huge dust and adds large amount of dust particles in open environment. The huge concentration of emitted dust causes air pollution, losses of water parameters and damages tissue of plant bodies. Dust in air creates irritating problems for the society. The villages located in wind corridors are continuously exposed to dust storms and facing problems related to respiratory system as well as lack of visibility while driving. The dust accumulation on open land transforms the land into non fertile land which imparts the production agricultural products. All these factors and affects call for effective and immediate preventive measures.

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